REMARKS/ARGUMENTS

Reconsideration of the above-identified application is respectfully requested in view of the foregoing amendments and the following remarks. Claims 2 - 4 and 12 have been cancelled. Claims 1, 8 - 11, 13 - 25, 28 - 31, 33, 34, 30 - 43, 46, 48, 49, 51, 52, 57 - 61, 66, 68, and 71 have been amended. Claims 77 - 81 have been added. Claims 1, 5 - 11, and 13 - 81 remain in the case.

The claims of the invention are drawn to a system and method for reliably and efficiently transporting data in a communications network. A novel method of issuing credits from a receiver to a transmitter us used, wherein rather than the issued credit merely indicating a number of byte that may be transmitted, the credits indicate specific ranges of bytes to be transmitted. Failure of a credit packet to arrive at the transmitter does not necessarily impede the overall data communication process as the transmitter may infer credits for earlier ranges of bytes upon receipt of a credit for a higher range of bytes. In addition, a unique application of a negative acknowledgement (NAK) system minimizes the number of bytes that must be retransmitted when an error is detected. Using implications arising from the novel credit system, the number of bytes that must be retained at the transmitter following transmission is also reduced thereby adding economy because of reduced buffer sizes.

Claims 1 - 7, 9 - 27, 29 - 45, 47 - 65, and 67 - 76 were rejected under 35 U.S.C. §103(a) as being unpatentable over United States Patent No. 6,594,701 for CREDIT-BASED METHODS AND SYSTEMS FOR CONTROLLING DATA FLOW BETWEEN A SENDER AND A RECEIVER WITH REDUCED COPYING OF DATA, issued July 15, 2003 to Alessandro Forin in view of United States Patent No. 6,683,850 for METHOD AND APPARATUS FOR CONTROLLING THE FLOW OF DATA BETWEEN SERVERS, issued January 27, 2004 to David S. Dunning et al.

FORIN teaches a system wherein credits issued by a receiver are used to control transmission of data from a

transmitter to the receiver. However, in the FORIN system, the credits specify only the magnitude of the data (i.e., the number of bytes) that may be transmitted. This approach has many limitations that are overcome in the novel approach of the present invention.

The method of the present invention provides a system of credits that are issued by a receiver to a transmitter. However, any similarity to the FORIN system ends there. In the system of the invention, credits issued by a transmitter to a receiver specify a specific range of bytes that may be transmitted. When a packet specifying a particular range of bytes is lost in transmission (i.e., never received at the transmitter), the transmitter may infer permission to transmit any intervening bytes when another, later credit is received. In other words, if a packet specifying credits for sending bytes A through D is lost or dropped and a subsequent credit packet permitting the sending of bytes E through H arrives, (assuming that E > D), the transmitter infers that it already received credits authorizing transmission of all bytes prior to E. This eliminates the overhead of requesting retransmission of a lost credit packet and significantly improves data throughput, particularly across "dirty" transmission paths where credit packets are more likely to be lost.

Compare the treatment of a lost credit pack in the FORIN system compared to the system of the instant invention. Assume that four credit packets are sent from the receiver to the transmitter, each credit packet authorizing transmission of N bytes, a total of 4N bytes during a time period T. In the scenario wherein one credit packet is lost, the FORIN and the inventive systems behave differently and their relative throughputs are also different.

FORIN SYSTEM:

If one credit packet is lost, the total number of bytes that can be transmitted during time period T is limited to 3N bytes corresponding to the actual credits received by the transmitter. Transmission of 4N bytes that would have been

otherwise permitted. The throughput loss associated with the lost credit can never be recovered.

INVENTIVE SYSTEM:

Assume credits are for sending bytes 0 through N-1, N through 2*N-1, 2*N through 3*N-1, 3*N through 4*N-1 have been sent from the receiver to the transmitter. Also assume that the second credit packet permitting transmission of bytes N through 2*N-1 is lost. When the next credit packet, permitting the transmission of bytes 2*N through 3*N-1 arrives, the transmitter infers that it was already permitted to send the earlier byte range (N through 2*N-1) corresponding to the lost packet. As a result, during the time period T, the sender still gets permission to send 4*N bytes.

Simply put, the inventive system and method maintains a higher level of data throughput compared to the throughput of FORIN.

Also, in the systems of the prior art such as that of FORIN, packets that are transmitted must be saved for a period of time because they may have to be retransmitted. However, the use of specific byte ranges within credits in accordance with the present invention implicitly indicate when such already transmitted data can be discarded. Earlier discard of transmitted data not only potentially reduces buffer sizes at the transmitter, but the housekeeping required to eventually discard correctly received data is reduced compared to prior art systems such as that of FORIN. FORIN provides no comparable feature, nor is there any motivation in FORIN to do so.

DUNNING et al. describe the use of negative acknowledgements (NAKs) to instruct a transmitter to resend the indicated packet(s) AND any subsequent packets. The system and the method of the present invention uses NAKs to retransmit ONLY the data specified in the NAK packet. Any other data (e.g., subsequently transmitted data) is NOT retransmitted. This avoids bandwidth wastage due to potentially redundant transmissions as, in the DUNNING et al.

system, some of the data transmitted "since then" may have been already received correctly.

The inventive system and method as now claimed clearly defines over FORIN. There is simply no teaching or suggestion in FORIN that would lead a person of average skill in the art to arrive at Applicants' novel approach to using credits containing specific byte ranges to be transmitted. Adding the teaching of DUNNING et al. to add a NAK feature to the teaching of FORIN still fails suggest Applicants' novel system.

Claims 1, 8 - 11, 13 - 25, 28 - 31, 33, 34, 30 - 43, 46, 48, 49, 51, 52, 57 - 61, 66, 68, and 71 have been amended to more clearly recite the novel features of Applicants' system. Consequently, the rejection of claims 1 - 7, 9 - 27, 29 - 45, 47 - 65, and 67 - 76 under 35 U.S.C. §103(a) as being unpatentable over FORIN in view of DUNNING et al. is believed overcome.

Claims 8, 28, 46, and 66 were rejected under 35 U.S.C. §103(a) as being unpatentable over FORIN of DUNNING et al. and further in view of United States Patent No. 6,594,721 for APPROXIMATED PER-FLOW RATE LIMITING, issued April 20, 2004 to David R. Cheriton. CHERITON uses credits on a per-packet basis; every packet to be transmitted requires an explicit credit. This is completely different from Applicants' system wherein a credit packet authorizes transmission of many data packets. Consequently, Applicants' system has lower overhead for managing credits on both the receiving side and the transmitting side of the communications data path.

Further, the CHERITON system permits a packet to be transmitted even when sufficient credits are not available. When a packet is received, the size of the data in the packet is compared against a credit value maintained in a table at the receiver. If the packet's data size exceeds the credit value, the packet is dropped. As that packet must eventually be retransmitted, the CHERITON method wastes bandwidth due to spurious transmissions. On the other hand, Applicants' novel system does not suffer from this disadvantage. In Applicants'

system, no correctly received packet ever need be retransmitted because no packet is transmitted until sufficient credits are received by the transmitter.

Nothing in CHERITON suggests that credit packet could authorize transmission of multiple packets as is done in Applicants' novel system. Neither does CHERITON teach or suggest that no packet be transmitted until sufficient credits are received. Consequently, combining the teaching of CHERITON to those of FORIN and DUNNING et al. as discussed hereinabove fails to suggest Applicants' novel approach to reliable, efficient data transmission.

The amendment of claims 1, 19, 39, and 57 from which claims 8, 28, 46, and 66 respectively depend, as well as claim 8, 28, 46, and 66 themselves is believed to overcome their rejection under 35 U.S.C. §103(a) as being unpatentable over FORIN in view of DUNNING et al. and further in view of CHERITON.

Claims 76 - 80 have been added.

Applicants believe that claims 1, 5 - 11, and 13 - 81, as amended, are now allowable and therefore respectfully request that they be allowed and the application passed to issue.

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